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## **Lampsilis cariosa Say and Lampsilis ochracea Say**

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Thomas Say described *Lampsilis cariosa* and *Lampsilis ochracea* in the first edition of Nicholson's Encyclopedia which appeared early in the year 1817. The present paper is an attempt to clarify the position of both species, for although they are distinct species, they have often been confused. The paper is based mainly on the extensive collections of both species in the Museum of Comparative Zoölogy and the United States National Museum. I wish to thank Dr. H. A. Rehder for the loan of the National Museum material and Dr. H. A. Pilsbry of the Academy of Natural Sciences of Philadelphia and Dr. J. R. Dymond of the Royal Ontario Museum of Zoölogy for allowing me to examine their collections. I am also indebted to Dr. Henry Vander Schalie of the Museum of Zoölogy of the University of Michigan for several records; to Dr. Gilbert Ranson of the Paris Museum for checking the identification of Lamarck's type of *Unio luteola*; and to Mr. H. D. Athearn for specimens from Massachusetts.

In the text, the initials USNM refer to the United States National Museum; MZM to the Museum of Zoölogy of the University of Michigan; ANSP to the Academy of Natural Sciences of Philadelphia; and MCZ to the Museum of Comparative Zoölogy.

### **Lampsilis cariosa Say**

*Unio cariosus* Say 1817, Nicholson's Encyclopedia [no pagination], pl. 3, fig. 2 (Delaware and Schuylkill Rivers; [Susquehanna River], Wilkesbarre [Pennsylvania] ).

*Unio luteola* Lamarck 1819, Animaux sans Vertèbres **6**, p. 79 (La rivière Susquehana et celle Mohancks [sic] ).

*Lampsilis pallida* Rafinesque 1820, Annales Générales des Sciences Physiques, Bruxelles **5**, p. 299 (Hudson River).

*Lampsilis ovata* Valenciennes 1833, [in] Humboldt and Bonpland, Voyage des Régions Equinoxiales du Nouveau Continent (2) **2**, p. 266, pl. 50, figs. 1a-c; non Say 1817.

*Lampsilis cariosa* Say, Simpson 1900, Proc. United States Nat. Mus. **22**, p. 528; Simpson 1914, Descriptive Catalogue of the Naiades, Detroit, Michigan **1**, p. 43; Ortmann 1919, Memoirs Carnegie Museum **8**, p. 313, pl. 20, figs. 3-5; Clench and Russell 1940, Biological Survey of the Connecticut Watershed, Survey Report no. 4, Concord, New Hampshire, pl. 4, fig. 4.

*Description.* Shell usually medium in size, about 90 to 100 mm. in length. Outline subovate or obovate, sometimes elliptical; rather short and high, except male specimens which may be somewhat elongated. Valves usually not much inflated. Anterior end regularly rounded, posterior end more broadly rounded and sometimes developed to a distinct blunt point. Ventral margin slightly curved or almost straight. Posterior ridge rounded and poorly defined. Dorsal margin straight or somewhat convex, usually terminating in a blunt angle with the obliquely descending posterior margin. Hinge ligament prominent. Beaks moderately swollen but not much elevated above the hinge line and located at the anterior third of the shell. The sculpture consists of four or five wavy, recurved ridges (see Marshall 1890, p. 182, fig. 8). Periostracum smooth and shining, usually bright wax or straw-yellow, infrequently greenish-yellow, sometimes becoming a dirty brownish-yellow or reddish-brown in old specimens. Rays either entirely absent or, if present, almost always limited to the posterior slope; they are usually greenish or blackish and form a sharp contrast against the light background. Hinge well developed. Pseudocardinals usually two in each valve, those in the left valve being compressed and serrated. The anterior tooth is somewhat triangular, the hinder one is low and rather long, located directly under the beak. The anterior tooth in the right valve is vestigial, the hinder one stumpy, serrated and triangular. Interdentum narrow. Two straight or gently curved laterals, which are somewhat elevated, truncated and raised toward their posterior ends are located in the left valve. One lateral tooth in the right valve. Beak cavities moderately deep, con-



Plate 19. Fig. 1. Female *Lampsilis cariosa* Say. Neoholotype MCZ 178839 from the Schuylkill River, near Philadelphia, Pennsylvania (natural size). Fig. 2. Male *Lampsilis cariosa* Say. Neallotype MCZ 151644 from the Schuylkill River, near Philadelphia, Pennsylvania (natural size) (photographs by F.P.Orchard).

taining dorsal muscle scars. Anterior adductor muscle scars well impressed, posterior ones not very distinct. Pallial line distinct. Nacre bluish-white or tinged with salmon. Sexual differences well marked in the shell. The male shell forms more or less of a point posteriorly, but the female shell is swollen in the post-basal area, which renders the posterior end broadly truncated.

	Length	Height	Width	
large (male)	137	87	58 mm.	Connecticut River, Hadley, Mass.
male (neotype)	73	45	30	Schuylkill River, Philadelphia, Pa.
female (neoholotype)	78	53	35	“ “ “ “

*Anatomy.* Ortmann (1912, p. 353) claims that the anatomy of *L. cariosa* is similar to that of *Lampsilis ovata ventricosa* Barnes.

*Types.* As Thomas Say's type of *Unio cariosa* does not exist, we here restrict the type locality to the Schuylkill River, near Philadelphia, Pennsylvania and select as neoholotype MCZ no. 178839, a female specimen whose measurements correspond approximately to those given by Say in the original description. A male shell from the same locality, MCZ no. 151644 is here selected as neotype. Neoparatypes, United States National Museum no. 84924. Lamarck's type of *Unio luteola* is in the National Museum in Paris. The description and type localities of this species would place it in the synonymy of *L. cariosa*. Lea, however, claimed (1833, Transactions of American Philosophical Society, n.s. 5, p. 91) that the type specimen was identical with *L. siliquioidea* Barnes, and as Dr. Gilbert Ranson of the Paris Museum assures me that Lea's identification is correct, it is doubtful if this specimen in question is truly Lamarck's type. The type of Rafinesque's *L. pallida* is not known to exist.

*Breeding Season.* According to Ortmann (1919, p. 315) this species is probably bradytictic. In Pennsylvania gravid females have been collected in the month of August.

*Host.* The specific host of the glochidia of this species is unknown, but as *L. cariosa* is restricted in its distribution to ponds and streams which drain into the Atlantic, it might possibly parasitize the alewife or some similar migratory fish.

*Distribution.* Simpson (1914, p. 44) gives the range of this species as "the Atlantic drainage from Georgia to the lower St. Lawrence." Ortmann (1919, p. 317) questioned the occurrence of this species in the lower St. Lawrence drainage, but specimens from the Raquette River in New York (a stream which flows into the St. Lawrence River) MCZ no. 97981 seem to be this species and not the closely related *Lampsilis ovata ventricosa* Barnes. Lachford (1882, p. 50) has reported *cariosa* from Black Bay, Eardley, Province of Quebec, and La Rocque and Oughton (1937, p. 152) have reported it from the Lake Ontario drainage and the Ottawa River and its tributaries. Having seen at least a portion of this material at the Royal Ontario Museum of Zoölogy, I am inclined to regard it as misidentified.

Gould (1870, p. 173) reports *L. cariosa* from ponds in Plymouth County, Massachusetts. The author and H. D. Athearn have collected in the area over a period of years and have found only *L. ochracea*. It is probable that Gould's record was based on a misidentification. The most southern record from the Ogeechee River, Georgia is based on a specimen in the Isaac Lea collection USNM no. 84915. It has a rather peculiar brownish-yellow periostracum, but it is undoubtedly this species.

*Ecology.* In general *L. cariosa* prefers the swift waters of larger streams, being found on gravelly bottoms and on sand bars.

*Records.* MAINE: [Penobscot River], Alton; Seven Tree Pond, Union; North Pond, Warren; South Pond, Warren; Chickawaukie Pond, Rockland; Kennebec River, Augusta (all MCZ). MASSACHUSETTS: Merrimac River, Haverhill; Connecticut River at Deerfield, Hadley and Chicopee (all MCZ). CONNECTICUT: Connecticut River, Windsor; Housatonic River, Kent (both USNM). NEW YORK: Raquette River, Potsdam; Champlain Canal; Hudson River, Albany; Canal at Troy; Mohawk River, Mohawk; Eaton (all MCZ). PENNSYLVANIA: Schuylkill River, near Philadelphia; Delaware River, Bucks County; Chester Creek, 18 miles south of Philadelphia; Susquehanna River, Sunbury and Duncannon (all MCZ). DISTRICT OF COLUMBIA: Potomac River (MCZ). NORTH CAROLINA: Neuse River, 5 miles

south of Raleigh (MCZ); Cape Fear River, Cumberland County (USNM). SOUTH CAROLINA: Congaree River (MCZ); [Savannah River] Edgefield and Abbeville Counties (both USNM). GEORGIA: Ogeechee River (USNM).

*Remarks.* As Ortmann (1919, p. 313) has pointed out, DeKay (1843, pl. 21, figs. 243, 244) has figured *Lampsilis ovata ventricosa* and not *L. cariosa*. Although related to the western *L. ovata ventricosa*, *L. cariosa* is quite distinct from it. In general, the latter is a smaller, less inflated shell, with hardly a trace of the posterior ridge which is usually present on the former. *L. cariosa* has a distinctive bright yellow, glossy periostracum; when rays are present they are almost always limited to the posterior slope. *L. ovata ventricosa* usually has a duller, olivaceous tint and is more inclined to be rayed over the entire surface.

Generally *L. cariosa* has been confused with *L. ochracea*. Hartmann and Michener (1874, fig. 183, 184) have figured the two sexes of *L. cariosa*, the male as *cariosa* and the female as *ochracea*. Simpson (1895, Nautilus 8, p. 121), trying to clarify these species, recopied these figures and inadvertently perpetuated the error. Gould (1870, fig. 475) has correctly figured a female specimen of *L. cariosa*, and though Ortmann (1919, p. 215) thought Gould's figure 476 was a male *L. cariosa* it is actually a male *L. ochracea*, the figure being based on a specimen in our collection (MCZ no. 89723).

Simpson (1914, p. 43) placed *Unio oratus* Conrad in the synonymy of *L. cariosa*, but its type locality, the Flint River, Georgia, would indicate that *oratus* is probably close to *L. virescens* Lea and not to our Atlantic drainage species.

#### **Lampsilis ochracea Say**

*Pectunculis Fluvialibus* [sic] Lister 1685, Synopsis Methodicae Conchyliorum, pl. 157, fig. 12 (Virginia).<sup>1</sup>

<sup>1</sup> Gmelin 1791. Systema Naturae, ed. 13, 1, pt. 6, p. 3359, named a shell from Europe *Mytilus fluvialilis*, referring to this figure of Lister as a shell which *approximated* the European shell he was then describing. As he did not specifically apply this name to Lister's figure, the name cannot be used for an American shell. Further, though Conrad (1836, p. 37) considered Lister's figure to represent Say's *L. ochracea*, the figure is sufficiently ambiguous so that Isaac Lea was successful for over fifty years in claiming that *M. fluvialilis* Gmelin was *Anodonta cataracta* Say!

*Unio ochraceus* Say 1817, Nicholson's Encyclopedia **2** [no pagination] pl. 3, fig. 8 (Delaware and Schuylkill Rivers).

*Lampsilis rosea* Rafinesque 1820, Annales Générales des Sciences Physiques, Bruxelles **5**, p. 299 (Hudson River).

*Unio rosaceus* Conrad 1850, Journal Acad. Nat. Sci. Philadelphia (2) **1**, p. 275, pl. 37, fig. 5 (Savannah River, Georgia).

*Unio affinis* var. Sowerby 1866, Conchologia Iconica **16**, pl. 63, fig. 318 *non* Lea 1852.

*Lampsilis ochracea* Say, Simpson 1900, Proc. United States Nat. Mus. **22**, p. 530; Simpson 1914, Descriptive Catalogue of the Naiades, Detroit, Michigan **1**, p. 49; Ortmann 1919, Memoirs Carnegie Museum **8**, p. 318, pl. 20, fig. 6, 7; Clench and Russell 1940, Biological Survey of the Connecticut Watershed, Survey Report no. 4, Concord, New Hampshire, pl. 4, fig. 3.

*Description.* Shell usually rather small, seldom exceeding 70 mm. in length. Rather strong, thin and often translucent. Outline ovate or subovate. Valves subinflated. Anterior end regularly rounded; posterior end usually produced to a blunt point. Ventral margin gently curved. Posterior ridge rounded and not very distinct. Dorsal margin slightly curved, terminating in a blunt angle with the obliquely descending posterior margin. Hinge ligament prominent. Beaks moderately full, but not much elevated above the hinge line; they are located slightly more than one third from the anterior end. Their sculpture consists of several recurved ridges (see Marshall 1890, p. 180, fig. 7). Periostracum smooth or slightly wrinkled, especially in the post-dorsal region. It may be brownish-olive, greenish-yellow, brownish, yellow, reddish-yellow, or grayish-green, and is seldom shiny. Rays may be entirely absent or if present, are often found over the entire surface of the shell to a varying degree. They are usually dull green, rather fine, and often not very distinct. Hinge not well developed. Left valve with two, in rare instances three, long, narrow, somewhat compressed pseudocardinals which are located in front of the beak. Right valve with two triangular, narrow, compressed pseudocardinals, separated by a deep narrow pit. The more anterior tooth is the smaller and lower one. They are both almost parallel to the hinge margin. Interdentum absent. The left valve has two thin gently curved, narrow laterals; the right valve one. Beak cavities shallow, containing dorsal muscle scars well impressed; posterior ones not very distinct. Pallial line not distinct. Nacre silvery-white, bluish-white and iri-

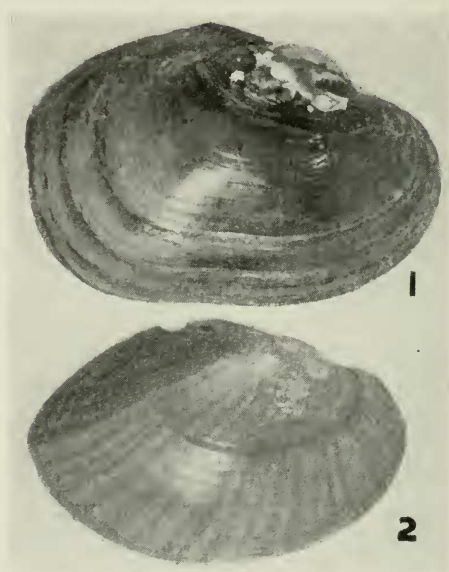


Plate 20. Fig. 1. Female *Lampsilis ochracea* Say. MCZ No. 159150 from Halfway Pond, Plymouth, Massachusetts (natural size). Fig. 2. Male *Lampsilis ochracea* Say. Neoholotype MCZ No. 178838 from the Schuylkill River, near Philadelphia, Pennsylvania (natural size) (photographs by F. P. Orchard).



descent; sometimes salmon or pinkish. Sexual differences similar to those of *L. cariosa* Say, but not always so well marked.

	Length	Height	Width	
large (male)	98	60	47 mm.	Bristol, Pennsylvania
male	65	36	28	Sampson Pond, South Carver, Mass.
female	60	42	26	" " " " "

*Anatomy.* Reardon (1929, p. 1) has made a rather complete study of the anatomy of this species.

*Types.* As Thomas Say's type of *Unio ochracea* does not exist, we here restrict the type locality to the Schuylkill River, near Philadelphia, Pennsylvania and select as neoholotype, MCZ no. 178838, a male specimen measuring 44 mm. in length, 30 mm. in height, and 18 mm. in width. These measurements correspond closely to those given by Say in the original description. Neoparatypes United States National Museum no. 84898. The type of Rafinesque's *L. rosea* is not known to exist. The figured holotype of Conrad's *Unio rosaceus*, is MCZ no. 178779. This specimen and nearly all the examples I have seen from the Savannah River have an attractive rose-tinted nacre.

*Breeding Season.* Lea (1863, Journal Academy of Natural Sciences of Philadelphia n.s. 5, p. 455) reports this species gravid in the autumn. I have found gravid females on May 3, 1943 in Plymouth, Massachusetts.

*Host.* The specific host of the glochidia is unknown, but like *L. cariosa*, *L. ochracea* seems to be restricted in its distribution to ponds and streams which drain into the Atlantic; but unlike *L. cariosa* which ascends rivers for a considerable distance, *L. ochracea* is restricted to the lower regions of streams. In view of the fact that it is found only in waters directly connected with the ocean, it may well parasitize the alewife or some similar migratory fish.

*Distribution.* Simpson (1914, p. 49) gives the range of this species, as "the Atlantic drainage from New England to the Ogeechee River, Georgia." Simpson's record from the Ogeechee River was based on Lea's *U. crocatus* which he placed in the synonymy of *L. ochracea*; however as *U. crocatus* is not

this species, the most southern authentic record of *ochracea* is from the Savannah River, Georgia.

*Ecology.* Unlike *L. cariosa* this species prefers ponds, canals and portions of rivers where the current is not too strong. It is usually found on a sandy or somewhat muddy bottom.

*Records.* MAINE: Seven Tree Pond, Union; South Pond, Warren; Chickawaukee Pond, Rockland (all MCZ). MASSACHUSETTS: Silver Lake, Kingston; Ashumet Pond, Hatchville; Wakeby Pond, Mashpee; Sampson Pond, South Carver; Halfway Pond and South Pond, Plymouth; Middleboro; Monponset Pond, Halifax (all MCZ). CONNECTICUT: Connecticut River (ANSP); Housatonic River, Kent (USNM). NEW YORK: Champlain Canal; Hudson River, Ulster County (both MCZ); Troy (USNM). NEW JERSEY: Delaware River at Burlington and Kaighns Point, Camden (both ANSP); Passaic River (USNM). PENNSYLVANIA: Schuylkill River, near Philadelphia; Delaware River, Bucks County; Bristol (all MCZ). DELAWARE: Seaford, Sussex County (ANSP). DISTRICT OF COLUMBIA: Potomac River; Anacostia River (both MCZ). MARYLAND: Mill Pond, Radcliff River, Chestertown (ANSP); Susquehanna River, Havre de Grace (MZM). VIRGINIA: Petersburg; James River (both USNM); Little Hunting Creek, near Mount Vernon; Canal, Alexandria; Matapike River, Matapike; York River (all MZM). NORTH CAROLINA: Lake Waccamaw, Columbus County (MCZ); Roanoke River, Weldon (USNM). GEORGIA: Savannah River (MCZ and USNM).

*Remarks.* Though *L. ochracea* has often been confused with *L. cariosa* they are quite distinct. In general *L. ochracea* has a thinner, smaller shell and unlike *L. cariosa* which is rarely rayed, *L. ochracea* is often rayed over the entire surface of the shell and has a rougher, duller, more greenish periostracum. The hinges are quite different: the pseudocardinals of *L. cariosa* are pyramidal, and a narrow interdentum is present, but in *L. ochracea* the teeth are lamellar and almost parallel to the hinge line and there is no interdentum.

Frierson (1927, p. 68) claimed that DeKay (1843, pl. 19, figs. 237, 238) correctly figured *L. ochracea*, but I am inclined to



Plate 21. Distributional patterns of *Lampsilis cariosa* Say and *Lampsilis ochracea* Say in Eastern North America. The circles indicate the distribution of *L. cariosa* and the triangles the distribution of *L. ochracea*.

agree with Ortmann (1919, p. 292) that the figures represent *L. radiata* Gmelin.

Simpson (1914, p. 50) placed *Unio crocatus* Lea in the synonymy of *ochracea*, but from an examination of the figured type, USNM no. 84908, here selected as lectotype, it appears to be closer to *Lampsilis constricta* Conrad. Frierson (1927, p. 68) points out that *Unio troostensis* (Conchologia Iconica 1866, **16**, pl. 38, fig. 210) *non* Lea, does not represent *L. ochracea* as thought by Simpson (1914, p. 50) but is *Nodularia aegyptiaca* Cailliaud.

Frierson (1927, p. 68) places *Unio boydianus* Lea in the synonymy of *Lampsilis ochracea* but the figured type, USNM 87126, here selected as lectotype, reveals it to be a young specimen of *Lampsilis siliquoidea* Barnes.

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